

exceedingly difficult to remove from wool. This weed has recently been reported³ from Salt Lake and Millard Counties, Utah.

INTERMOUNTAIN HERBARIUM,
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Some Effects of Cold on Plants in Alabama in 1940

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The winter of 1939-40 was the coldest for many years in Alabama. The average temperature for fifty-three stations, scattered over the state, was 12.2° below normal in January, 3.0° below in February, 0.6° in March, and 1.1° in April. At Tuscaloosa the mean temperature for January was 32.9° F., as compared with a normal of 45.1°. About six inches of snow fell the night of the 22nd, and it covered the ground completely for about a week, and partly for another week. In Pickens, the next county on the west, which in most winters has no snow at all, nearly two feet of snow was reported in some places. Temperatures below zero Fahrenheit were reported in Tuscaloosa on several consecutive nights during the week that the ground was covered with snow. Although the mean temperatures for February, March and April were only a little below normal, there was a killing frost nearly throughout the state on the night of April 12-13.

The first noticeable effect of cold on plants in Tuscaloosa in 1940 was frost ribbons issuing from the base of a cultivated shrub, apparently *Lantana Camara*, on the morning of January 2. I had published a few notes on this phenomenon (the latest in *TORREYA* for February, 1938), but had no record of its occurrence on a woody plant before, unless the splitting off of the bark of orange trees in Florida in severe freezes is caused by such ice formation. The *Lantana* is not hardy in Tuscaloosa, where it dies down to the ground every winter, and usually comes up from the roots again in the spring. But that cold spell seems to have killed it completely, and I have seen none here since.

³ Cottam, W. P., Garrett, A. O., and Harrison, B. F. New and extended ranges for Utah plants. *Utah Univ. Bul.* 30:7. 1940.

Penfound and Mackness, in the Spring 1940 issue of the Louisiana Conservation Review, discussed the damage to exotic woody plants in and around New Orleans by the freezing weather of late January, and gave long lists of species moderately or severely injured, with half-tone illustrations of some of them after the freeze. The lowest temperature of that month in New Orleans was 20° F., on the 19th (several days before the zero weather in Tuscaloosa), but the monthly average was nearly as low as in Tuscaloosa, namely, 34.9°, or 20° below normal. Although the cold was not nearly as extreme in New Orleans, it did much more damage there than in Tuscaloosa, on account of the large number of semi-tropical plants cultivated there that can stand very little frost.

The principal effect of the late January cold on native plants in and around Tuscaloosa was to delay the blooming of *Alnus* and *Ulmus* about a month, and of the oaks about two weeks. This had a curious effect on *Quercus laurifolia*, which is fairly common on sandy banks of streams in the southern half of Alabama, and is also cultivated for shade. It is essentially evergreen, but usually drops most of its old leaves about the time its flowers and new leaves appear, in March. But in 1940 the old leaves dropped at about the usual time, and the new foliage was delayed by the cold, so that the tree looked surprisingly bare for a time.¹

Cultivated plants in Tuscaloosa suffered more, for some people are always trying to cultivate tender plants as far north as possible, and severe winters naturally give them a setback. I made no careful notes at the time, but the following observations were jotted down a few weeks later, and pertain mostly to the University campus. *Aleurites* (tung oil tree) and *Pittosporum Tobira* seem to have been killed completely. *Cinnamomum Camphora*, *Feijoa Sellowiana* (a small Myrtaceous tree from South America), *Millettia reticulata* (an evergreen leguminous vine from eastern Asia), and one or more species of *Ligustrum* were killed to the ground, and did not recover sufficiently to bloom that year. *Eriobotrya Japonica*

¹ Spring was late here in 1941 also, not because of any extreme cold, but on account of prolonged cool weather; and the oaks were again about two weeks late in blooming. But it seems that the leaves of *Quercus laurifolia* which were two weeks late in starting in 1940 hung on for a full year anyway, so that they lasted until flowering time in 1941. This point will be discussed more farther on.

(loquat) was badly nipped, and lost some of its branches, but bloomed again the following winter as usual. (It never makes any fruit here, as it does in Florida.) But curiously enough, *Elaeagnus pungens*, which Penfound and Mackaness reported as injured by the 20° temperature in New Orleans, did not seem to suffer noticeably from the zero weather in Tuscaloosa.

The frost of April 12-13, with a minimum recorded temperature of 26° at Tuscaloosa, came when the leaves of most of our deciduous trees were about half grown, and some of them were in bloom. The following morning I went about ten miles up the Warrior River, and found the leaves of all species of *Hicoria*, *Quercus* and *Fraxinus* frozen and wilted; even *Quercus montana*, which grows as far north as Massachusetts. The same thing happened to the leaves of *Magnolia macrophylla* on the campus, and doubtless in the woods too. But herbaceous plants seemed to be almost uninjured, except for a few with very delicate foliage, such as *Osmorrhiza* (*Washingtonia*).

Other effects of this same killing frost became apparent later in the year. It destroyed the fruit crop on all or nearly all the *Hicoria*, annual-fruited *Quercus*, *Vitis*, *Diospyros*, and cultivated pecans and peaches in the northern half of Alabama. But in Autauga County, near the center of the state, which I visited in late summer, the pecans, muscadines and persimmons seem to have borne a normal crop, or nearly so.

Some other effects of the cold winter did not become evident until fall. It seems that the falling of deciduous leaves is due not only to decreasing temperatures in the fall, but also to the accumulation of mineral salts in them, which the tree gets rid of and returns to the soil in that way.² It is doubtless largely for this reason that evergreens are characteristic of poor soils and cold and dry climates; and on very poor soils the leaves of trees may last two or more years before they get so impregnated with mineral matter that their usefulness is ended.

The trees around Tuscaloosa got such a late start in 1940 that by the second week in November most of the deciduous leaves had not yet matured sufficiently to form the abscission layer at the base of the petiole, which detaches them from the stem. So a severe

² See Am. Fern Journal, 9: 100. 1920.

frost the night of the 15th-16th caught many of them still green, and caused them to wilt and hang down much as a late spring frost would. And there they hung until about a week later, when a rain added enough weight to bring most of them down.

This was especially noticeable in *Ginkgo*, *Celtis*, *Broussonetia*, *Platanus*, *Magnolia macrophylla*, *Liquidambar*, *Albizia*, *Acer saccharinum*, *Hibiscus Syriacus*, *Melia* and *Lagerstroemia*, all cultivated in Tuscaloosa, some native and some exotic. I did not have a good opportunity to go out in the woods at that time to see how the wild trees were affected.

In this connection it seems worth while to digress and note another instance of the duration of leaves being determined by age, in which temperature did not seem to be a factor. On and near the University campus there are a few young specimens of *Quercus lobata*, the California white oak, from seeds I planted in the winters of 1936-37 and 1937-38. The largest of these in the middle of 1940 was about five feet tall. In its native haunts in California it gets no rain in summer, and presumably makes very little growth at that season. But July, 1940, was unusually rainy in Tuscaloosa, with 12.55 inches of rain instead of the normal of 5.21, and the little tree added about a foot to its height during that month.

In November it dropped its leaves, like other deciduous trees, except on the uppermost foot, where the leaves had not yet served their time, so to speak. A photograph of it taken on December 18 showed the young terminal shoot still leafy and the rest of the tree bare. After that these last and youngest leaves dropped gradually, but the uppermost and youngest one hung on until about February 1, when it was about six months old, which is the approximate normal duration of deciduous leaves in this climate.

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